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FLOOD INSURANCE STUDY

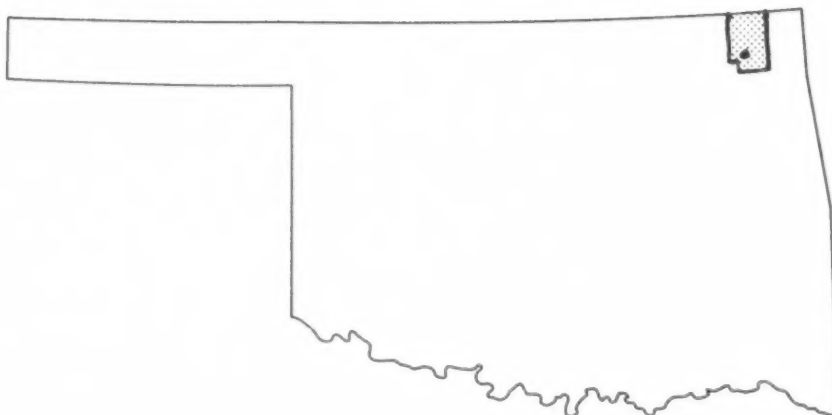


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CITY OF VINITA,
OKLAHOMA
CRAIG COUNTY



DECEMBER 1, 1980



federal emergency management agency
federal insurance administration

COMMUNITY NUMBER 400050

FEMI-209



TABLE OF CONTENTS

	<u>Page</u>
1.0 <u>INTRODUCTION</u>	i
1.1 Purpose of Study	i
1.2 Authority and Acknowledgments	i
1.3 Coordination	i
2.0 <u>AREA STUDIED</u>	2
2.1 Scope of Study	2
2.2 Community Description	2
2.3 Principal Flood Problems	7
2.4 Flood Protection Measures	12
3.0 <u>ENGINEERING METHODS</u>	16
3.1 Hydrologic Analyses	16
3.2 Hydraulic Analyses	17
4.0 <u>FLOOD PLAIN MANAGEMENT APPLICATIONS</u>	19
4.1 Flood Boundaries	19
4.2 Floodways	19
5.0 <u>INSURANCE APPLICATION</u>	24
5.1 Reach Determinations	25
5.2 Flood Hazard Factors	25
5.3 Flood Insurance Zones	25
5.4 Flood Insurance Rate Map Description	26

TABLE OF CONTENTS - continued

6.0	<u>OTHER STUDIES</u>	<u>Page</u> 26
7.0	<u>LOCATION OF DATA</u>	26
8.0	<u>BIBLIOGRAPHY AND REFERENCES</u>	26,28

FIGURES

Figure 1 -	Vicinity Map	3
Figures 2-4 -	Photographs showing the estimated flood elevations in the City of Vinita	13-15
Figure 5 -	Floodway Schematic	24

TABLES

Table 1 -	Summary of Discharges	16-17
Table 2 -	Floodway Data Table	21-23
Table 3 -	Flood Insurance Zone Data	27

EXHIBITS

Exhibit 1 -	Flood Profiles	
	Big Cabin Creek	Panels 01P-03P
	Bull Creek	Panels 04P-06P
	Elm Creek - Elm Creek Tributary	Panels 07P-08P

Exhibit 2 - Flood Boundary and Floodway Map Index

Exhibit 3 - Flood Boundary and Floodway Map

PUBLISHED SEPARATELY:

Flood Insurance Rate Maps Index

Flood Insurance Rate Maps

FLOOD INSURANCE STUDY CITY OF VINITA, OKLAHOMA

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study investigates the existence and severity of flood hazards in the City of Vinita, Craig County, Oklahoma, and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study will be used to convert the City of Vinita to the regular program of flood insurance by the Federal Insurance Administration (FIA). Local and regional planners will use this study in their efforts to promote sound flood plain management.

In some states or communities, flood plain management criteria or regulations may exist that are more restrictive or comprehensive than those on which these Federally-supported studies are based. These criteria take precedence over the minimum Federal criteria for purposes of regulating development in the flood plain, as set forth in the Code of Federal Regulations at 24 CFR, 1910.1 (d). In such cases, however, it shall be understood that the state (or other jurisdictional agency) shall be able to explain these requirements and criteria.

1.2 Authority and Acknowledgments

The source of authority for this Flood Insurance Study is the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

The hydrologic and hydraulic analyses for this study were performed by Benham-Blair & Affiliates, Inc., for the Federal Insurance Administration, under Contract No. H-4642. This study was completed in November, 1979. All field survey data for this study was completed and compiled by Benham-Blair & Affiliates, Inc., Oklahoma City, Oklahoma.

1.3 Coordination

The Consultation Coordination Officer (CCO) appointed by the Federal Insurance Administrator, organized the first community meeting, held on March 14, 1978. This meeting, attended by representatives of the City of Vinita, FIA, and Benham-Blair and Affiliates, Incorporated, was held to explain the nature and the purpose of the Flood Insurance Study.

A legal notice announcing the beginning of the study and stating its objective was placed in the local newspaper.

Contact was maintained during the course of this study with the Craig County Soil Conservation Service District Office, planners at Northeast Counties of Oklahoma Economic Development Association (NECO) and the City of Vinita for general community information.

On April 29, 1980, the results of the Flood Insurance Study were reviewed at a final CCO meeting attended by personnel of the study contractor, FIA, and representatives of the City of Vinita. The results of the study were presented to and accepted by the community.

2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the City of Vinita, Craig County, Oklahoma. The area of study is shown on the Vicinity Map (Figure 1).

The limits of detailed studies in Vinita were determined by the FIA with representatives of the community and study contractor at the meeting in March, 1978. The City of Vinita is surrounded on three sides by flood prone areas. This report studied the three major sources of possible flooding as follows:

- a. Big Cabin Creek, from the confluence of Bull Creek to a point above the confluence of Elm Creek.
- b. Bull Creek, from the confluence with Big Cabin Creek to a point upstream of Eastern State Hospital Road.
- c. Elm Creek, from the confluence with Big Cabin Creek to the E.W. section road, north of Section 10, T25N, R20E, which includes an unnamed tributary labeled as Elm Creek Tributary.

The areas studied by detailed methods were selected with priority given to all known flood hazard areas, and areas of projected development or proposed construction for the next five years, through November 1984.

2.2 Community Description

The City of Vinita is located in northeastern Oklahoma in the south central portion of Craig County. The city is situated approximately 65 miles northeast of Tulsa, Oklahoma, and approximately 30 miles southwest of Miami, Oklahoma. The city has a major transportation network, routed through or in close proximity. U.S. Highways 66, 69, 60 and State Highway

2 are major routes through the state, particularly U.S. 69 which connects Kansas City, Missouri to Dallas-Fort Worth, and Houston. Additionally, Interstate Highway 44 is adjacent with an exit on the east side of Vinita. The city also has two major railway services with the St. Louis - San Francisco Railway (Frisco) and the Missouri-Kansas-Texas Railroad (Katy) intersecting within the corporate limits.

The city is bounded on the west by Big Cabin Creek while Bull Creek lies adjacent to the eastern portion of Vinita. A smaller tributary of Elm Creek runs parallel to the northern corporate limits outside of the city. The possibility of flooding surrounds the majority of the existing corporate area. There are areas for expansion northward and northwesterly. The City of Vinita does not exercise its extra-territorial jurisdiction at the present time.

The City of Vinita has basically the same type of economy which it has had since its inception; this being an agriculture service center. The vast cattle lands, which surround the city, have been the primary contributor to this development. Moreover, from the turn of the century until shortly after World War II, Vinita was a major transportation center for Northeast Oklahoma. Vinita continues to be a retail trade, commercial and farm center for Craig County, as well as adjoining section of Mayes, Rogers, Ottawa and Delaware Counties.

In Vinita one primary commercial area seems to be in existence which is in the vicinity of the intersections of Illinois, Canadian and Delaware Streets with Wilson Street. This area forms the Central Business District of the city. Strip commercial seems to predominate on Wilson Street, south of its intersection with Delaware Street. Also strip development is located along Illinois Street east of First Street. Moreover, Wilson Street north of the St. Louis-San Francisco Railway seems to be rapidly developing in the vicinity of the "Wal-Mart Discount Center" and stock yards. Vinita has 95.5 acres of development devoted to commercial usage. (Reference 1). In 1970, the population of Vinita was 5,847, a decrease of approximately 3% over the 1960 census of 6,027. (Reference 2).

The most extensive developments are located between the east bank of Big Cabin Creek and the west bank of Bull Creek. The majority of the remaining land is devoted to agricultural or related purposes. Interstate Highway 44 crosses both Big Cabin and Bull Creeks on the southern edge of the city near the beginning of this study. U.S. Highway 66 also crosses both creeks, just above the interstate crossing on both creeks.

The climate of Vinita can basically be classified as a humid, sub-tropical. By this classification, the spring and autumn months are mild with warm days and cool nights and summers are long and not usually hot; winters are comparatively mild, but brief periods of extremely cold weather occur in some years.

Average daily maximum temperatures average about 44 degrees F in January and 92 degrees F in July, and daily minimum temperatures are 26 degrees F in January and 69 degrees F in July. Temperatures of 90 degrees F or higher occur as early as March and as late as October, and are common during the summer months. During an average year, temperatures of 90 degrees F or higher are registered on approximately 60 days during the summer months. During the warmer months of July and August, daytime temperatures reach the 100 degree mark approximately 10 days of an average year (Reference 3).

In the colder part of the year, freezing temperatures are recorded on an average of 92 days each year. Surges of cold arctic air, pushing southward through the Central United States, occasionally cause temperatures of zero or below. These extremely cold temperatures occur on an average of one night each year and it is usually only a brief period after sunrise before the temperature has risen well above zero again.

Average yearly precipitation in Vinita is 42 inches. Maximum precipitation occurs in late spring and early summer in the form of frequent thunderstorms. May is the wettest month receiving 14 percent of the years total precipitation and June follows closely with 13 percent of the total. A secondary precipitation maximum occurs in September and October which is 11 and 9 percent respectively of the years total.

Precipitation is more general and widespread during the autumn and winter months compared to the showery, scattered precipitation patterns of spring and summer. Winter is the driest season with only 14 percent of the years total.

Prevailing winds in Vinita are from a southerly direction in all months except January and February when northerly winds predominate. Average yearly wind speeds in Vinita and vicinity are from 10 to 12 miles per hour, decreasing from 13 miles per hour in March and April to 9 miles per hour in July, August and September. When storm centers move across Oklahoma and Kansas during the spring months, winds of 30 to 40 miles per hour are not uncommon. Strong gusty winds will also occur with thunderstorms and during winter months, strong gusty northerly winds are common behind cold fronts. Severe thunderstorms, tornados have occurred during every month of the year, but are more frequent during April, May and June.

The topography of Vinita and its general vicinity could best be described as gently rolling. No areas of over 3 to 5 percent slope seem to be present in the general vicinity. Vinita is virtually surrounded on three sides by flood prone areas which are in most 1/2 mile to 1 mile wide. The only possible area which is free from flood prone area is to the north and west of the city. These flood prone areas form definite constraints on the possible future urbanization pattern of Vinita. The flood prone areas of Vinita will, in the future, play a large part in the development of the city. Some rather densely urbanized portions of the city are presently in these flood prone areas.

Watershed Descriptions

Big Cabin Creek heads in the northern portion of Craig County, Oklahoma, and flows southerly approximately 50 miles across northeastern Oklahoma prior to its confluence with the Neosho River at the head of Lake Hudson. The total drainage area of Big Cabin Creek is 466 square miles.

The drainage area at the confluence with Bull Creek, which begins this study, is 252 square miles. The headwater reach of the watershed is about 10 miles wide, increasing to about 25 miles to include Paw Paw Creek, Bull Creek and Little Cabin Creek watersheds. From the mouth of Big Cabin Creek to Vinita, the watershed is from 6 to 13 miles wide.

Elevations in some parts of the headwater area are 1,000 feet above National Geodetic Vertical Datum of 1929 (NGVD). The valley is flanked by rolling uplands that reach heights of over 200 feet above the valley floor generally from 1 to 5 miles back from the river. The slope toward the valley proper is rather steep, resulting in a rapid runoff from the tributary streams. In the vicinity of Vinita, the hills have an elevation of about 800 feet NGVD and the valley floor is about elevation 600 feet NGVD.

Big Cabin Creek has a well defined channel though very crooked. It varies in width from about 100 feet near Vinita, to about 30 feet near Pyramid Corners, Oklahoma, and is occasionally obstructed by snags, trash heaps and gravel bars. The banks are generally stable, vary in height from 15 to 20 feet, and are covered with brush and trees above the low water line.

The total fall of Big Cabin Creek from its headwaters to its junction with the Neosho River is 360 feet. Throughout most of its length, excluding the upper reach, the average fall of the stream bed is slightly over 5 feet per mile.

Within the reach of this study, Big Cabin Creek has two significant tributaries, being, Bull Creek and Elm Creek.

Bull Creek, with a total drainage area of 16 square miles, joins Big Cabin Creek about 1.6 mile south of the Interstate Highway 44 crossing. The watershed at Bull Creek lies within Craig County. The creek originates northeast of Vinita and flows in a southwesterly direction through the eastern part of Vinita to its junction with Big Cabin Creek. The drainage basin is shaped like an elongated rectangle. Its length is about 8 miles and its width averages about 2 miles. The majority of the basin is devoted to agricultural purposes before the stream enters the corporate limits of Vinita.

Elevations in the basin range from a maximum of 860 feet NGVD down to a stream bed elevation of 650 feet NGVD at the confluence with Big Cabin Creek. The average slope of the watershed is about 8.5 feet per mile.

This study covers the lower 5 miles of Bull Creek. The creek winds through the City of Vinita and in a channel which varies from a narrow deep channel to a wide, shallow channel with a flood plain varying from about 1,000 feet to 3,000 feet in width.

Elm Creek is a much smaller tributary to Big Cabin Creek. This tributary is outside the existing corporate limits. However, the city proposes to annex this area in the near future. Due to the physical location adjacent to the expanding community it was decided to study Elm Creek and Elm Creek Tributary as one continuous stream from its confluence with Big Cabin Creek to the north section line at Section 10, T25N, R20E. Presently, this basin is devoted mainly to agriculture usage with several sparsely developing residential areas.

Soils play a predominate part of the City of Vinita. Because of their low permeability much runoff is present in the city. Moreover, the general soils group of the city have a low compressibility and high shrink-swell. Two primary soil associations make up the soil pattern of Vinita. The largest area is composed of the Dennis-Parsons-Taloka Association which are deep, nearly level to gently sloping loamy soils that have a loamy and clayey sub-soil over loamy sediment shale or clay on upland area. The other soil association is that of the Verdigris-Radley-Lightening Association which are deep, nearly level, loamy soils that are loamy throughout or have a clayey sub-soil; over loamy or clayey sediment on flood plains. This association is found primarily in the vicinity of Big Cabin Creek, Bull Creek and Elm Creek in the vicinity of Vinita.

2.3 Principal Flood Problems

The past history of flooding on the waterways within and adjacent to the City of Vinita is generally in the spring and summer months. The majority of the large floods are a result of continuous heavy rains, however, flooding on the smaller creeks is due to intense local thunderstorms moving in a northeasterly direction across northeastern Oklahoma.

Investigation of local history sources, newspaper files and interviews with local residents revealed numerous flooding instances on Big Cabin and Bull Creeks. The largest known floods in the Vinita area were those May 10 through 20, 1943, September 30 through October 6, 1959 and May 19 through May 22, 1961.

The following are excerpts from newspaper accounts of the 1943 and 1959 floods.

Vinita Daily Journal
Monday, May 10, 1943

ROADS BLOCKED IN AREA AS RAIN FLOODS STATE

Creeks in Vinita region of banks, rainfall sets high mark for day - Roads in northeastern Oklahoma were blocked today with Vinita practically isolated on three sides by floods that followed one of the heaviest rains on records here. Showers Thursday night that developed into a downpour late Friday continued almost without ceasing through Saturday, Sunday, and today, sent creeks sprawling all over the countryside in this area . . . Highway 66 was covered with water west of Vinita today, but traffic was still going through. Rainfall gage at R.E. Moss Florist showed 7.03 inches of rain during Sunday, a record marked for a 24-hour period . . .

Vinita Daily Journal
Monday, May 17, 1943

RAINS, STORMS SWEEP STATE FOR MONTH'S SECOND FLOOD

- Damage caused over state in heavy rainfall; Vinita receives about 4" of rain during 12 hours -

On the heels of the floods followed torrential rains last weekend, balance storms struck Vinita and other sections of the state during the night to cause additional damage throughout Oklahoma. Although only about 4" of rain were reported for Vinita during the early morning hours, the rainfall fell on already soaked earth that sent creeks easily climbing out of their banks to reach proportions even greater than the seven inches of a week ago in some sections. A downpour around 5:00 this morning in Vinita flooded City Streets

Vinita Daily Journal
Tuesday, May 18, 1943

AREA TRAFFIC HAULTS AS RAIN REVIVES FLOOD WATERS REACH RECORD MARK

- Roads blocked in sections as creeks go up -

Record breaking flood waters surged through Vinita and the whole northeast Oklahoma today on the heels of an 8-inch rain which fell in 36 hours and continued today. Vinita was completely isolated by the rampaging waters . . . rose over Highway 66 both east and west of the city. "Highest the water's ever been", came from the lips of many of the Vinita citizens as they were rescued from the rising waters in the early hours of the morning when Bull Creek surged out of its banks in the northeast part of the city. Highway 66 west of Vinita was inundated for 1-1/2 miles and

passenger and car traffic was halted at 1:00 a.m. Two or three feet of water threatened to wash the pavement away, but at 5:00 a.m. Tuesday, the water started to recede and had fallen 5" by 10:00 a.m. this morning . . . "By 9:00 last night the streets were as full of water as I've ever seen them", Mayor Martin said, "and the rain was still going". Vinita sales ground and the city park along Bull Creek were flooded extensively as water stood in the house of Fritz Ray at the fairgrounds and water crept up only a few feet from the Vinita swimming pool. Waters were also up around the residence properties in the south part of the city as Big Cabin rises higher and higher throughout the southwest of the city . . .

Vinita Daily Journal
Wednesday, September 30, 1959

STORM HEADS NORTH AS DAMAGES CLIMB, CREEKS OVERFLOW AS RAIN CONTINUE

Creeks and other streams in this area continued to overflow in bottom lands today as steady rains fell for the fourth straight day. Rainfall since last Wednesday officially measured 11.24 inches up to 7:00 a.m. today, local observer E.T. McCollum said. Big and Little Cabin Creek, as well as Bull Creek and other streams in the area, were out of their banks again today. Bridges on all major highways in the area, however, remained above water as late at 2:00 p.m. today, according to Vinita Police Station . . .

Vinita Daily Journal
Thursday, October 1, 1959

Police Chief Dougan Bresnehn reported that floodwaters from creeks in this area were believed to be receding. He said the road leading to the city sewage disposal plant south of Vinita, was underwater today, but that the bridges on the Highways in this area were above water

Vinita Daily Journal
Friday, October 2, 1959

HIGH WATERS FORCE VINITIANS TO VACATE

Heavy rainfall brings flooded creeks in areas. Bull Creek on rampage as downpour hits . . . Damage to run high in Craig County . . . Between 15 and 20 families living in the northeast corner of Vinita were evacuated from their homes earlier today when floodwaters from Bull Creek inundated a wide area of lowlands. Bull Creek, already swollen by recent rains, overflowed into residential areas earlier today as a result of a torrential downpour Thursday night and today. Bull Creek began to recede today about 9:00 a.m., but most of the inundated houses were still under water this afternoon. The evacuation started at about 6:00 a.m. today when the families awakened to find their houses surrounded by water that had crept

up during the night. Some houses were merely surrounded by water, but others had as much as 4 and 5 feet of water in them. Rainfall in the Vinita area Thursday night and up to 7:00 a.m. today measured 5.46 inches, local observer E.T. McCollum said. Precipitation in the past week, prior to the latest measurement, totaled well over 11 inches. High water in the Vinita area stranded two MKT railroad trains here today and trains on the Frisco were also held up, it was reported. Officials said that Big and Little Cabin Creeks remained below the bridges on U.S. 66 east and west of Vinita today. However, the creeks were reported to be still rising. U.S. 66, however, was closed west of Vinita.

Other flood notes: A trailer house located in back of Burt Parkhurst's Grocery Store, 404 North 2nd Street, was in several feet of water. The man in the trailer was evacuated. At least one garage was torn off of its foundation by the swift flood waters and one house in the 400 Block North 3rd Street was turned halfway around on its foundation. Houses were partially underwater in an area from North 1st Street to North 4th Street between East Illinois Avenue and East North Avenue. All Houses in this area, however, were not affected

Vinita Daily Journal
Saturday, October 3, 1959

HIGHWAY IN AREA BLOCKED BY HIGH WATER

Steady rains fell in Craig County Friday night as Big Cabin Creek, Little Cabin, and Bull Creek continued to spill over their banks, shutting off traffic on U.S. 66 both east and west of Vinita. Local rainfall in the 12-hour period ending at 7:00 p.m. Friday amounted to 1.97 inches, boosting the one-week total to well over one foot. Floodwaters from Big Cabin Creek located west of Vinita washed over the Highway at 11:00 a.m. Friday and traffic was stopped at noon. State Highway Department stationed at the east edge of Big Cabin floodwaters said the creek was continuing to rise slowly as late as 5:00 p.m. Its peak had been expected at about midnight until new heavy rains began later Friday evening. Continued rise on Big and Little Cabin Creeks posed serious threats to a number of houses in the Vinita area. Bull Creek, which burst over its bank and inundated several blocks in the northeast part of the city early Friday morning, had quickly returned to its banks by mid afternoon Friday. However, the continued heavy rainfall caused Bull Creek a new rise later Friday afternoon. Police and other city employee and volunteers worked early Friday to rescue between 15 and 20 families in the northeast section. Policeman Norman Rosa, who lives at 445 North 3rd Street and whose house was flooded Friday, estimated that floodwaters entered a total of about 35 houses in that area early Friday

Vinita Daily Journal
Tuesday, October 6, 1959

CITY REQUESTED \$160,000 FOR FLOOD REPAIR

City of Vinita today asked \$160,000 in Federal Disaster Aid to repair flood damaged streets, sewer, and other city owned property, Mayor Jack Williamson announced. Vinita and Craig County are included in the 13 county area of eastern Oklahoma proclaimed as a major disaster area by Governor Howard Edmondson.

The northeastern section of Vinita was hard hit last week when Bull Creek flooded, damaging many houses and other property in that area . . .

Vinita Daily Journal
Friday, May 19, 1961

DAMAGE HIGH AS AREAS HIT BY FLASH FLOOD

"About 30 persons comprising an estimate 15 or 18 families were moved to higher grounds this morning when torrential rains set off a flash flood on Bull Creek that caused heavy damage to property. No one was reported injured. The water entered some homes on the northeast part of the city and surrounded many others. The flood waters were receding early this afternoon. The heavy rains which began shortly after 3:00 a.m. today continued without letup for more than 7 hours. The precipitation measured 2.8 inches by 7:00 a.m. Unofficial estimates of the total rainfall ranged up to more than 6 inches . . .

"Two Feet below 1959"

"The flood came to within two feet of the high water mark set in the flood of 1959, observers said. Bryant said that the flooded area was between East Sequoyah Avenue and East Clyde Avenue on North 2nd, 3rd 4th Streets. Burt Parkhurst's Grocery Store, at the corner of East Tahlequah Avenue and North 2nd Street, was in two feet of water this morning before the water began to recede about 11:00 a.m. Meanwhile, Big Cabin Creek continued to rise and the Highway Department predicted the water would over U.S. 69, west of Vinita by 3:00 p.m. today. During this morning's thunderstorm Vinita Police Department said that "Big Cabin Creek was rising 6 inches every 90 minutes." . . .

Vinita Daily Journal
Saturday, May 20, 1961

WATER RECEDING AFTER HEAVY RAIN

"Bull Creek, a usually docile little stream which turned into a raging torrent Friday because of 5.57 inch rainfall, is returning to normal today. Flood

water crept into dozens of houses in the northeast part of Vinita before they subsided. About 30 persons had to be evacuated in trucks or boats. The American Red Cross said indications were that Friday, the flood affected nearly as many families as two years ago when Bull Creek went on a rampage. About 37 families received aid then." ...

Gage records published by the U.S. Geological Survey in the booklet "Flood Characteristics of Oklahoma Streams" indicate that the peak discharges on Big Cabin Creek, since 1935 have been of low recurrence frequency, mostly less than the 25 year discharge. The only exception noted was May 18, 1943 which has a discharge of 63,000 cfs. The 25 year frequency peak is 58,500 and the 50 year frequency is 72,700 cfs. This would indicate that, though various flooding instances have occurred the city has never experienced a major catastrophe flood since recorded data has been available.

High water marks on Bull Creek indicate that the 1961 storm was less than a 100 year frequency storm. The high water mark at the Parkhurst's Grocery Store located at E. Tahlequah Avenue and North 2nd Street was approximately 680.3 feet. The 100 year elevation at this store would be approximately 681.8. There are no published records on Bull Creek, though observations of high water marks in conjunction with recorded rainfall indicate that Bull Creek, without the influence of Big Cabin Creek has experienced more severe flooding problems in past years.

Figures 2 through 4 show the estimated flood elevations of the 100-year and 500-year magnitude within the City of Vinita.

2.4 Flood Protection Measures

Appreciable flood protection measures have not been employed within the corporate limits of Vinita. Existing development on Bull Creek lies immediately adjacent to the creek banks. The majority of the land adjacent to Big Cabin Creek is pasture, thus flood damages have not been significant. If new developments are planned in this area they should be flood proofed either by elevating the structures or other acceptable methods.

There are no flood control dams on Big Cabin Creek or on Elm Creek. Small farm ponds do detain some flood runoff for small duration storms. However they rapidly fill during storms of extensive duration or intense rainfall. Upstream of the Eastern Oklahoma State Hospital is an existing lake. This has been used at various times for flood protection, however, the majority of the time the lake remains brim-full which affords no flood protection. This lake was originally the water supply for the hospital.

There are no other flood protection measures known to exist or to be planned in the near future for Vinita.

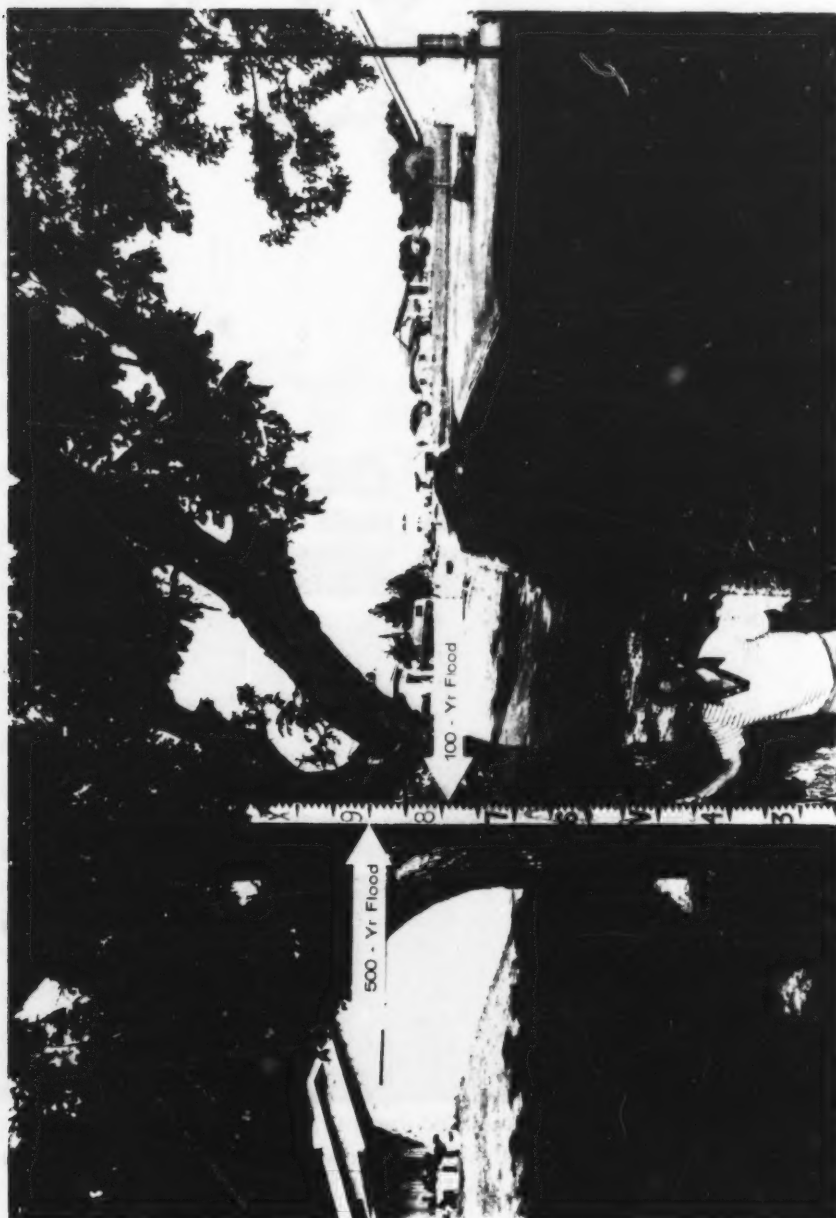


FIGURE 2: Big Cabin Creek-Looking north at the intersection of Jennie Lane and Section Line Road.

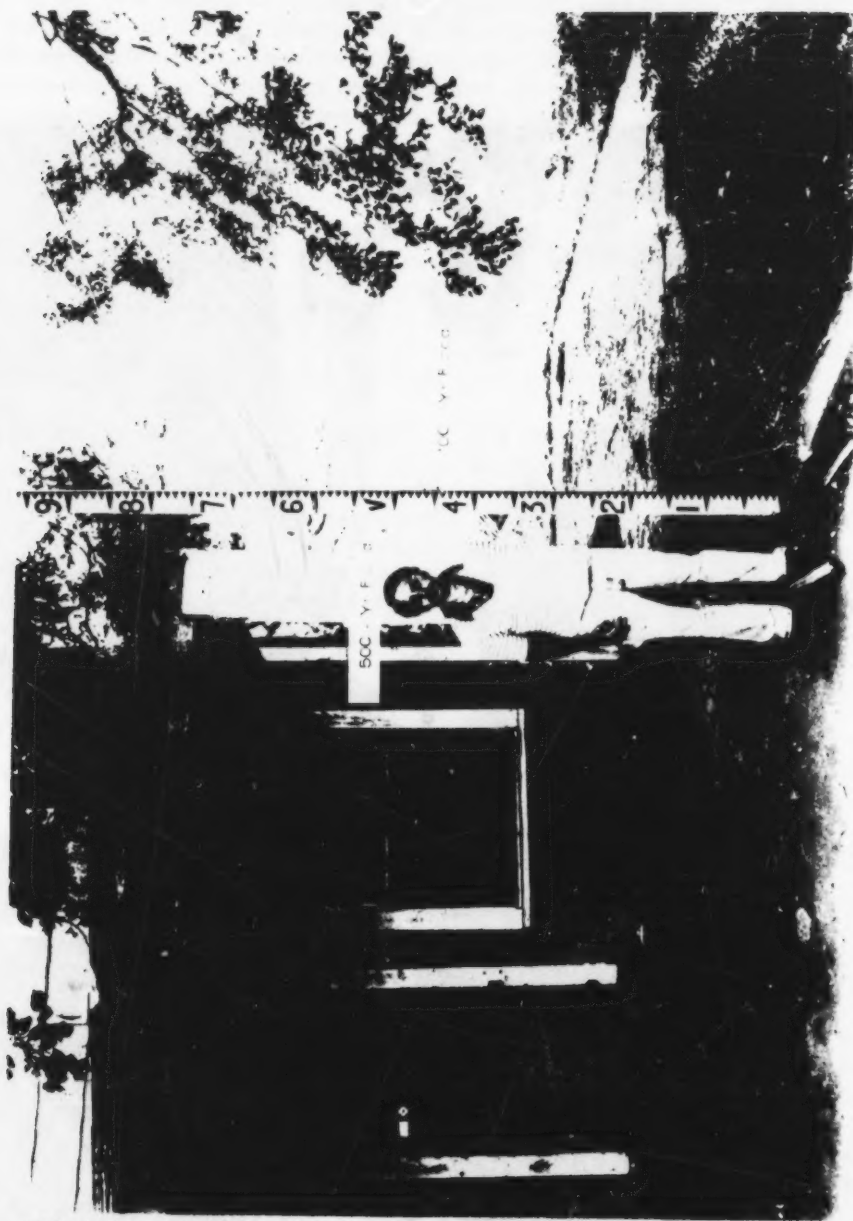


FIGURE 3: Bull Creek-Old Parkhurst Grocery located on west bank of Bull Creek at intersection of North 2nd Street and E. Tahlequah Avenue.



FIGURE 4: Bull Creek-Farmer and Ranchers Livestock Auction Building located on east side of Bull Creek adjacent to the south side of Highway 66.

3.0 ENGINEERING METHODS

For the flooding sources studied in detail in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude which are expected to be equalled or exceeded once on the average during any 10-, 50-, 100-, and 500-year period (recurrence intervals), have been selected as having special significance for flood plain management and for flood insurance premium rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10, 2, 1, and 0.2 percent chance, respectively, of being equalled or exceeded during any year. Although the recurrence interval represents the long term, average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than one year are considered. For example, the risk of having a flood which equals or exceeds the 100-year flood (one percent chance of annual occurrence) in any 50 year period is about 40 percent (four in 10), and for any 90 year period, the risk increases to about 60 percent (six in 10). The analyses reported here reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish peak discharge-frequency relationships for floods of the selected recurrence intervals for each flooding source studied in detail in the community.

The hydrologic analysis on Big Cabin and Bull Creek was evaluated with assistance of discharge records available from the gaging station near Big Cabin, Oklahoma. The peak discharges are based on statistical analysis of records covering a 35-year period (Reference 4). The recorded data was used to evaluate the regression coefficients for the study watersheds above the gage location on Big Cabin Creek. Mean annual precipitation figures from the booklet "Techniques for Estimating Flood Discharges for Oklahoma Streams", (Reference 5) were used in conjunction with the regression formulas for the rural and urbanized areas, for establishing the peak discharges for the selected recurrence intervals.

The peak discharge-drainage area relationships for the selected recurrence intervals are presented in Table 1, "Summary of Discharges."

TABLE 1 - SUMMARY OF DISCHARGES

<u>FLOODING SOURCE AND LOCATION</u>	<u>DRAINAGE AREA (sq. miles)</u>	<u>PEAK DISCHARGES (cfs)</u>			
		<u>10-YEAR</u>	<u>50-YEAR</u>	<u>100-YEAR</u>	<u>500-YEAR</u>
BIG CABIN CREEK Upstream of Confluence with Bull Creek	234	--	--	53,663	--

Upstream of Will Rogers Turnpike (I-44)	232.6	--	--	53,438	--
Upstream of Confluence with Paw Paw Creek	179.1	--	--	44,503	--
Upstream of Confluence with Elm Creek	177.5	--	--	44,225	--
BULL CREEK					
Upstream of Will Rogers Turnpike (I-44)	15.0	4.271	6,951	9,751	10,873
Upstream of Rodeo Grounds	13.5	3,975	6,456	9,084	10,068
Upstream of North Avenue	11.5	3,543	5,736	8,111	8,903
ELM CREEK					
Confluence with Big Cabin Creek	11.2	4,360	7,211	10,822	11,432
ELM CREEK TRIBUTARY					
Confluence with Elm Creek	1.9	1,257	2,008	3,176	3,344
Upstream of North-South Section Line Road (Adair Street Extended)	1.5	1,027	1,632	2,603	2,740

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of the flooding sources studied in detail in the community were carried out to provide estimates of the elevations of floods of the selected recurrence intervals along each of the flood sources.

No previous studies have been evaluated for the streams studied by detailed methods in the City of Vinita. Several years ago the Soil Conservation Service had discussed the possibility of doing a watershed study on Big Cabin Creek but no report or preliminary study was ever undertaken.

Starting conditions for all frequency discharges for Big Cabin and Bull Creeks were determined by slope-area method with consideration for stage discharge data for the 10 and 50 year frequency discharges provided by USGS as previously described. Elm Creek starting conditions were in conjunction with backwater elevations on Big Cabin Creek since coincident floods on the tributary and main stream of Elm Creek are probable.

Cross sections for the backwater analyses of all the study creeks were obtained by field survey in March 1979, by the study contractor. Dimensions for smaller structures were also obtained during field surveys.

The below-water sections were obtained by field measurement. All bridges, dams, and culverts were field checked to obtain elevation data and structural geometry, to coordinate with design plans obtained from the Oklahoma Highway Department and the Oklahoma Turnpike Authority, on U.S. Highway 66 and the Will Rogers Turnpike (I-44). Bridge plans were also provided by Missouri-Kansas-Texas Railroad and St. Louis-San Francisco Railway and field checked for accuracy. Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles (Exhibit 1). For stream segments for which a floodway was computed (Section 4.2), selected cross section locations are also shown on the Flood Boundary and Floodway Map (Exhibit 3).

Channel roughness factors (Manning's "n") used in the hydraulic computations were chosen by engineering judgment and based on field observations of the streams and flood plain areas. Roughness values on the main channel of Big Cabin Creek range from 0.024 through the bridges to 0.070 in the natural channel with values in the overbanks ranging from 0.045 to 0.090. Big Cabin Creek has a natural channel being well defined and rather consistent in width throughout the study. The channel has areas of meandering but the majority of the channel is straight. Bull Creek is a smaller creek with a less defined channel due to urbanization and land-scaping throughout the residential areas. Mannings coefficients for the main channel range from 0.024 to 0.080 with the flood plans varying from 0.040 to 0.090 for all floods. Elm Creek and Elm Creek Tributary have a drainage area consisting of farm and pastureland. Roughness coefficients range from 0.024 to 0.080 for the main channel and 0.050 to 0.080 for the overbank areas of the study.

The acceptability of all assumed hydraulic factors, cross sections, and hydraulic structure data was checked by observed high water marks on Bull Creek. On Big Cabin and Elm Creeks, there were no observed high water marks with an assigned frequency storm to correlate to the results of the study.

Water-surface elevations of floods of the selected recurrence intervals were computed through use of the COE HEC-2 Step-Backwater Computer Program (Reference 6). Flood Profiles were drawn showing computed water-surface elevations to an accuracy of 0.5 foot for floods of the selected recurrence intervals.

All elevations are referenced from the National Geodetic Vertical Datum of 1929, (NGVD) formerly referred to as Sea Level Datum of 1929; elevation reference marks used in this study are shown and described on the maps.

The hydraulic analyses for this study were based on unobstructed flow. The flood elevations shown on the profiles are thus considered valid only if hydraulic structure remain unobstructed, operate properly, and do not fail.

Since no floodway was determined on Big Cabin Creek and the scope of the study required only the 100 year frequency discharge be elevated, the results of the hydraulic analyses were tabulated at selected cross sections as shown on Table 2.

4.0 FLOOD PLAIN MANAGEMENT APPLICATIONS

The National Flood Insurance Program encourages state and local governments to adopt sound flood plain management programs. Therefore, each Flood Insurance Study includes a flood boundary map designed to assist communities in developing sound flood plain management measures.

4.1 Flood Boundaries

In order to provide a national standard without regional discrimination, the 100-year flood has been adopted by the FIA as the base flood for purposes of flood plain management measures. The 500-year flood is employed to indicate additional areas of flood risk in the community. For each stream studied in detail, the boundaries of the 100- and the 500-year floods have been delineated using the flood elevations determined at each cross section; between cross sections, the boundaries were interpolated using topographic maps at a scale of 1:24,000 with a contour interval of 20 feet (Reference 7). In cases where the 100- and the 500-year flood boundaries are close together, only the 100-year boundary has been shown.

For the streams studied by approximate methods, the boundary of the 100-year flood was developed from normal depth calculations and the topographic maps referenced below.

The boundaries of the 100- and 500-year floods are shown on the Flood Boundary and Floodway Map (Exhibit 3). Small areas within the flood boundaries may lie above the flood elevations, and, therefore, may not be subject to flooding. Owing to limitations of the map scale and/or lack of detailed topographic data, such areas are not shown.

4.2 Floodways

Encroachment on flood plains, such as artificial fill, reduces the flood-carrying capacity, increases the flood heights of streams, and increases flood hazards in areas beyond the encroachment itself. One aspect of flood plain management involves balancing the economic gain from flood plain development against the resulting increase in flood hazard. For purposes of the National Flood Insurance Program, the concept of a floodway is used as a tool to assist local communities in this aspect of flood plain management. Under this concept, the area of the 100-year flood is divided into a floodway and a floodway fringe. The floodway is the channel of a stream plus any adjacent flood plain areas that must be kept free of encroachment in order that the 100-year flood may be carried without sub-

stantial increases in flood heights. Minimum standards of the FIA limit such increases in flood heights to 1.0 foot, provided that hazardous velocities are not produced. The floodways in this report are presented to local agencies as minimum standards that can be adopted or that can be used as a basis for additional studies.

The floodways presented in this study were computed on the basis of equal conveyance reduction from each side of the flood plain. The results of these computations were tabulated at selected cross sections for each stream segment for which a floodway was computed (Table 2).

As shown on the Flood Boundary and Floodway Map (Exhibit 3), the floodway widths were determined at cross sections; between cross sections, the boundaries were interpolated. In cases where the boundaries of the floodway and the 100-year flood are either close together or collinear, only the floodway boundary has been shown.

The area between the floodway and the boundary of the 100-year flood is termed the floodway fringe. The floodway fringe thus encompasses the portion of the plain that could be completely obstructed without increasing the water-surface elevation of the 100-year flood more than 1.0 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to flood plain development are shown in Figure 2.

FLOODING SOURCE		FLOODWAY ²			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE ¹	WIDTH (FT.)	SECTION AREA (SQ. FT.)	MEAN VELOCITY (F.P.S.)	REGULATORY (NGVD)	WITHOUT FLOODWAY (NGVD)	WITH FLOODWAY (NGVD)	INCREASE (FEET)
Big Cabin Creek ³ A B C D	10,950	6,302	56,147	1.70	681.33	681.33	*	*
	15,200	5,652	50,096	1.56	681.53	681.53	*	*
	16,480	5,873	51,943	1.44	681.60	681.60	*	*
	17,344	7,234	53,593	1.85	681.63	681.63	*	*

¹Feet above downstream limit of detailed study

²Floodway not determined, data given is for 100-year flood

³Outside corporate limits

*Not computed

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CITY OF VINITA, OK
(CRAIG CO.)

FLOODWAY DATA

BIG CABIN CREEK

TABLE 2

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE ¹	WIDTH (FT.)	SECTION AREA (SQ. FT.)	MEAN VELOCITY (F.P.S.)	REGULATORY (NGVD)	WITHOUT FLOODWAY (NGVD)	WITH FLOODWAY (NGVD)	INCREASE (FEET)
Bull Creek								
A*	10,817	425	4,670	2.1	681.0	669.4 ³	670.4	1.0
B*	12,711	267	1,891	5.2	681.0	672.8 ³	673.7	0.9
C*	13,211	608	4,088	2.4	681.0	673.5 ³	674.5	1.0
D*	14,893	478	4,172	2.2	681.0	677.9 ³	678.2	0.3
E*	16,225	200	2,720	3.3	681.0	680.5 ³	680.5	0.0
F	16,787	240	2,553	3.6	681.6	681.6	681.7	0.1
G	17,177	230	2,623	3.5	681.6	681.6	682.0	0.4
H	17,525	230	2,002	4.5	681.6	681.6	682.0	0.4
I	18,285	591	4,602	2.0	681.8	681.8	682.8	1.0
J	19,885	319 ²	1,637	5.0	683.3	683.3	684.0	0.7
K	26,200	575	3,102	2.6	695.4	695.4	696.3	0.9

¹Feet above mouth

²This width extends beyond the corporate limits

³Water-surface elevations determined without considering backwater effects

*Outside corporate limits

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Federal Insurance Administration

CITY OF VINITA, OK

(CRAIG CO.)

TABLE 2

FLOODWAY DATA

BULL CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE ¹	WIDTH (FT.)	SECTION AREA (SQ. FT.)	MEAN VELOCITY (F.P.S.)	REGULATORY (NGVD)	WITHOUT FLOODWAY (NGVD)	WITH FLOODWAY (NGVD)	INCREASE (FEET)
Elm Creek and Elm Creek Tributary* A ² B ² C ² D ² E F G H	400	879	7142	1.5	683.0	682.6 ³	683.6	1.0
	1,885	919	8267	1.3	683.0	682.8 ³	683.8	1.0
	4,685	516	4568	2.4	683.3	683.3	684.2	0.9
	5,367	698	5094	2.1	683.5	683.5	684.4	0.9
	7,167	410	3079	3.5	685.4	685.4	686.3	0.9
	11,649	282	1965	1.3	695.2	695.2	696.1	0.9
	15,369	187	360	7.2	704.2	704.2	704.3	0.1
	19,569	172	834	3.1	717.7	717.7	718.6	0.9

¹Feet above mouth of Elm Creek

²Not shown on Map; located outside mapping limits

³Water-surface elevations determined without considering backwater effects

*Outside corporate limits

TABLE 2

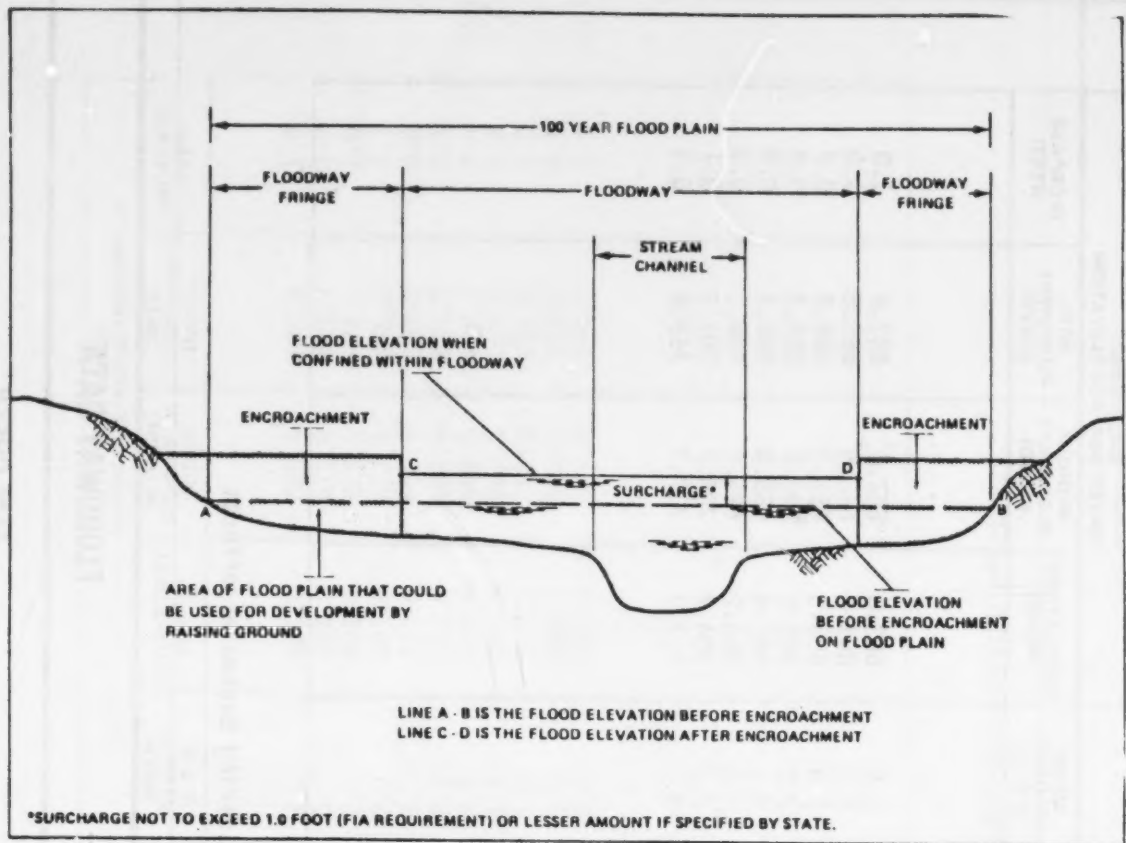
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FLOODWAY DATA

ELM CREEK



FLOODWAY SCHEMATIC

Figure 5

A floodway was not determined for Big Cabin Creek since it would be completely outside of the corporate limits.

5.0 INSURANCE APPLICATION

In order to establish actuarial insurance rates, the FIA has developed a process to transform the data from the engineering study into flood insurance criteria. This process includes the determination of reaches, Flood Hazard Factors (FHF's), and flood insurance zone designations for each significant flooding source affecting the City of Vinita.

5.1 Reach Determinations

Reaches are defined as lengths of watercourses having relatively the same flood hazard, based on the average weighted difference in water-surface elevations between the 10- and 100-year floods. This difference does not have a variation greater than that indicated in the following table for more than 20 percent of the reach.

<u>Average Difference Between 10- and 100- Year Floods</u>	<u>Variation</u>
Less than 2 feet	0.5 foot
2 to 7 feet	1.0 foot

Two (2) reaches meeting the above criteria were required for the flooding sources in the City of Vinita. The locations of the reaches are shown on the Flood Profiles (Exhibit 1) and summarized in the Flood Insurance Zone Data Table (Table 3).

5.2 Flood Hazard Factors (FHF's)

The Flood Hazard Factor is used to correlate flood information with insurance rate tables. Correlations between property damages from floods and their assigned FHF's are used to set actuarial insurance premium rate tables based on FHF's from 005 to 200.

The FHF for a reach is the average weighted difference between the 10- and 100-year flood water-surface elevations expressed to the nearest one-half foot, and shown as a three-digit code. For example, if the difference between the water-surface elevations of the 10- and 100-year floods is 0.7 foot, the FHF is 005; if the difference is 1.4 feet, the FHF is 015; if the difference is 5.0 feet, the FHF is 050. When the difference between the 10- and 100-year flood water-surface elevations is greater than 10.0 feet, the accuracy for the FHF is to the nearest foot.

5.3 Flood Insurance Zones

After the determination of reaches and their respective FHF's, the entire incorporated area of the City of Vinita was divided into zones, each having a specific flood potential or hazard. Each zone was assigned one of the following flood insurance zone designations.

Zones A4 and A11:

Special Flood Hazard Areas inundated by the 100-year flood, determined by detailed methods, base flood elevations shown, and zones subdivided according to FHF's.

Zone B:

Areas between the Special Flood Hazard Area and the limits of the 500-year flood, including areas of the 500-year flood plain that are protected from the 100-year flood by dike, levee, or other water control structure; areas subject to certain types of 100-year shallow flooding where depths are less than 1.0 foot; or areas subject to 100-year flooding from sources with drainage areas less than 1 square mile. Zone B is not subdivided.

Zone C:

Areas of minimal flooding.

Table 3, "Flood Insurance Zone Data," summarizes the flood elevation differences, FHF's, flood insurance zones, and base flood elevation for each flooding sources studied in detail in the community.

5.4 Flood Insurance Rate Map Description

The Flood Insurance Rate Map for the City of Vinita, is, for insurance purposes, the principal result of the Flood Insurance Study. This map (published separately) contains the official delineation of flood insurance zones and base flood elevation lines. Base flood elevation lines show the locations of the expected whole-footwater-surface elevations of the base (100-year) flood. This map is developed in accordance with the latest flood insurance map preparation guidelines published by the FIA.

6.0 OTHER STUDIES

A Flood Hazard Bounday Map dated May 28, 1976, has been published for the City of Vinita. The information given in this study supersedes the information contained in the previously published map and is authoritative for purposes of the Flood Insurance Program. No other studies are known to exist for any of the streams within the corporate limits of the City of Vinita.

7.0 LOCATION OF DATA

Survey, hydrologic, hydraulic, and other pertinent data used in this study can be obtained by contacting the Insurance and Mitigation Division, Federal Emergency Management Agency, Federal Center, Denton, Texas 76201.

8.0 BIBLIOGRAPHY AND REFERENCES

- I. The Northeast Counties of Oklahoma Economic Development Association (NECO), Comprehensive Plan for the Year 2000-Vinita, Oklahoma, June, 1976.

FLOODING SOURCE	PANEL ¹	ELEVATION DIFFERENCE ² BETWEEN 1.0% (100-YEAR) FLOOD AND			FHF	ZONE	BASE FLOOD ELEVATION ³
		10% (10 YR.)	2% (50 YR.)	0.2% (500 YR.)			
Big Cabin Creek Reach 1	0001,0002	-5.32	-2.22	+1.13	055	A11	Varies
Bull Creek Reach 1	0001,0002	-2.02	-0.99	+0.43	020	A4	Varies

¹FLOOD INSURANCE RATE MAP PANEL
²WEIGHTED AVERAGE
³ROUNDED TO NEAREST FOOT-SEE MAP

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CITY OF VINITA, OK
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FLOOD INSURANCE ZONE DATA

BIG CABIN CREEK-BULL CREEK

TABLE 3

2. U.S. Department of Commerce, Bureau of Census, 1970 Census of Population, Number of Inhabitants, Oklahoma, Washington, D.C., 1971.
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4. U.S. Geological Survey, Water Resources Investigation 52-73, Flood Characteristics of Oklahoma Streams, January 1974.
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6. U.S. Army Corps of Engineers, Hydrologic Engineering Center, HEC 2, Water-Surface Profile, Generalized Computer Program, Davis, California, October, 1973.
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Scale 1: 24,000

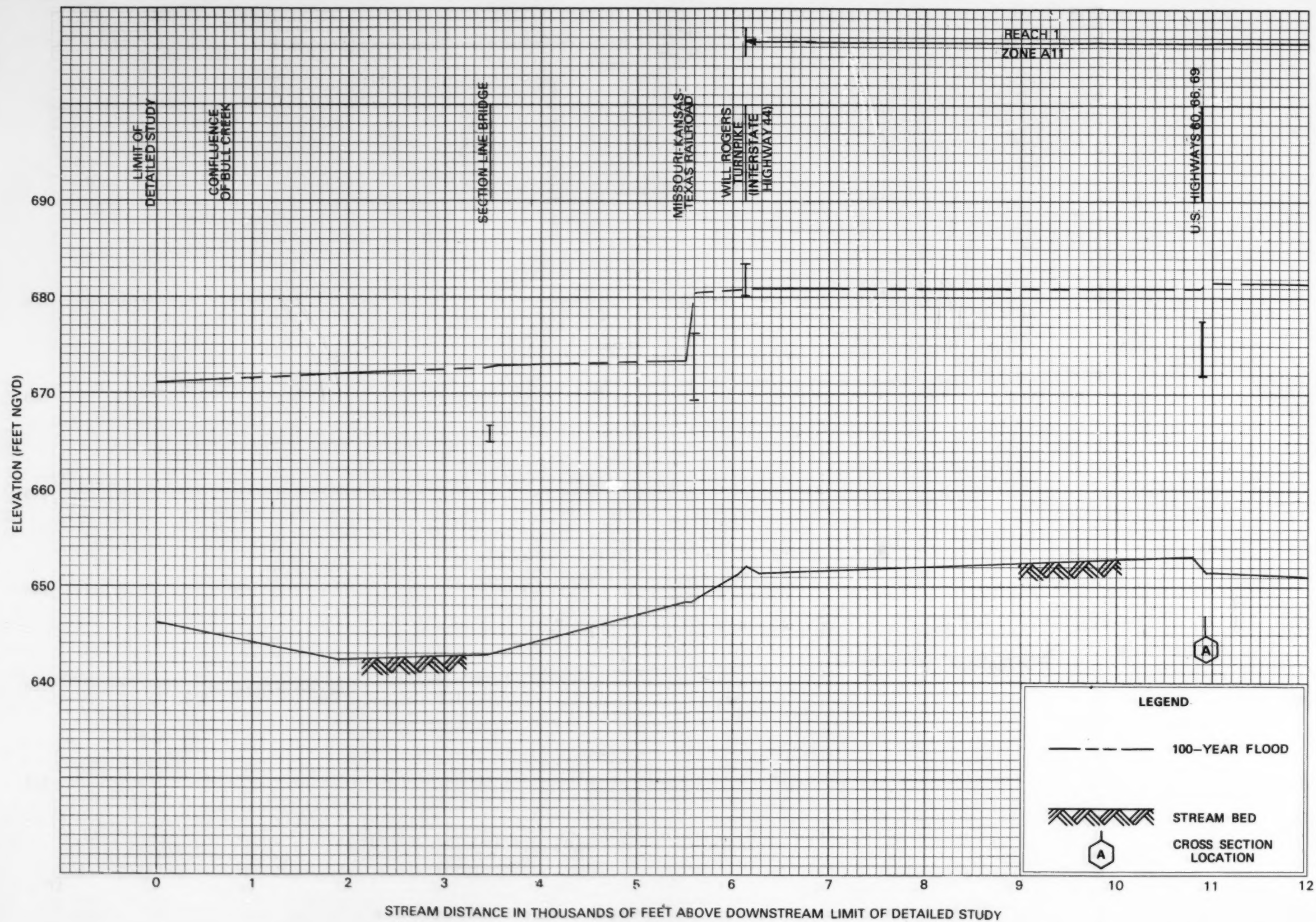
Contour Interval 10 Feet:

Big Cabin, Oklahoma

N 3630 - W 9507.5/7.5 1971

Vinita, Oklahoma

N 3637.5 - W 9507.5/7.5 1971



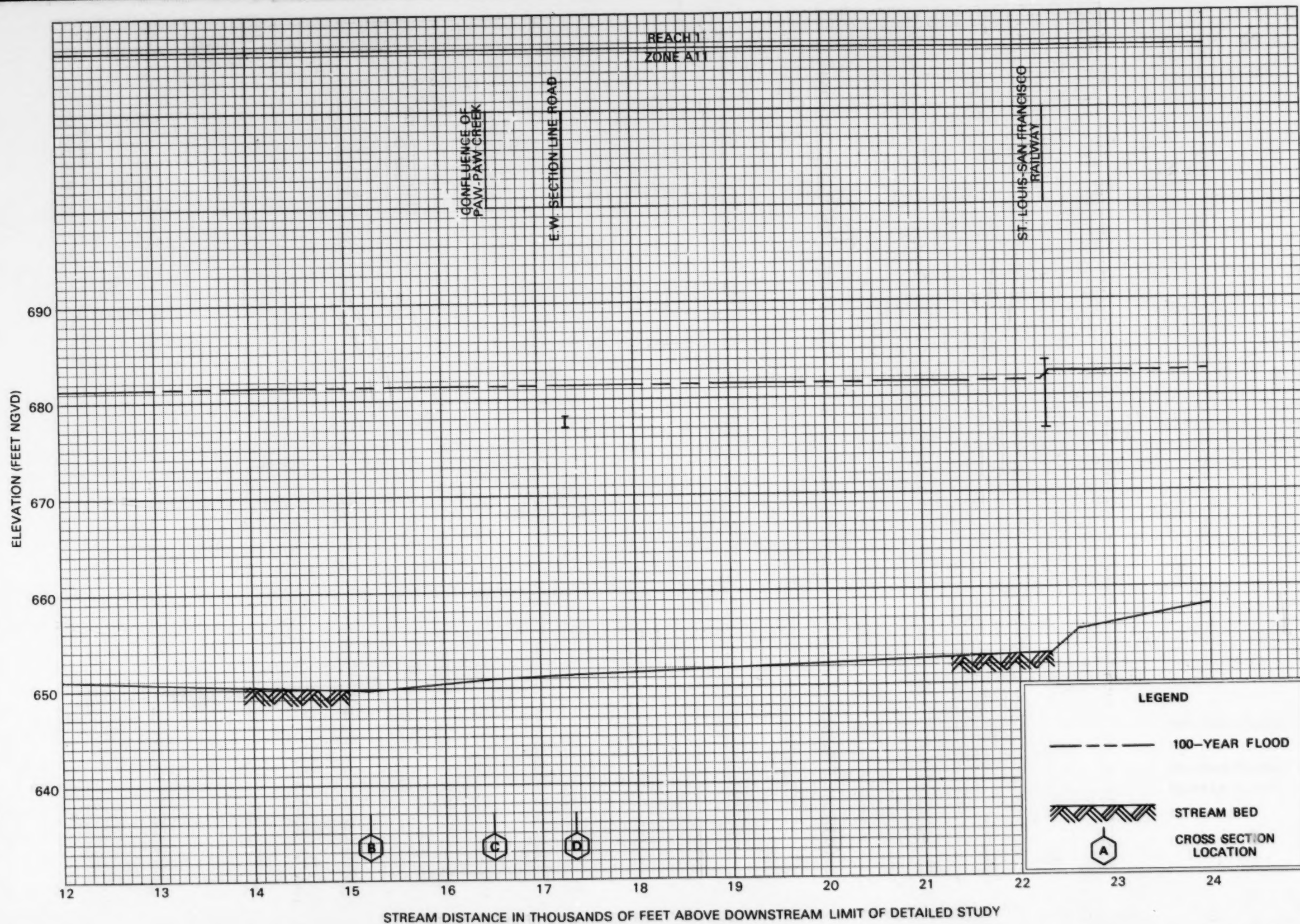
FLOOD PROFILES

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FLOOD PROFILES

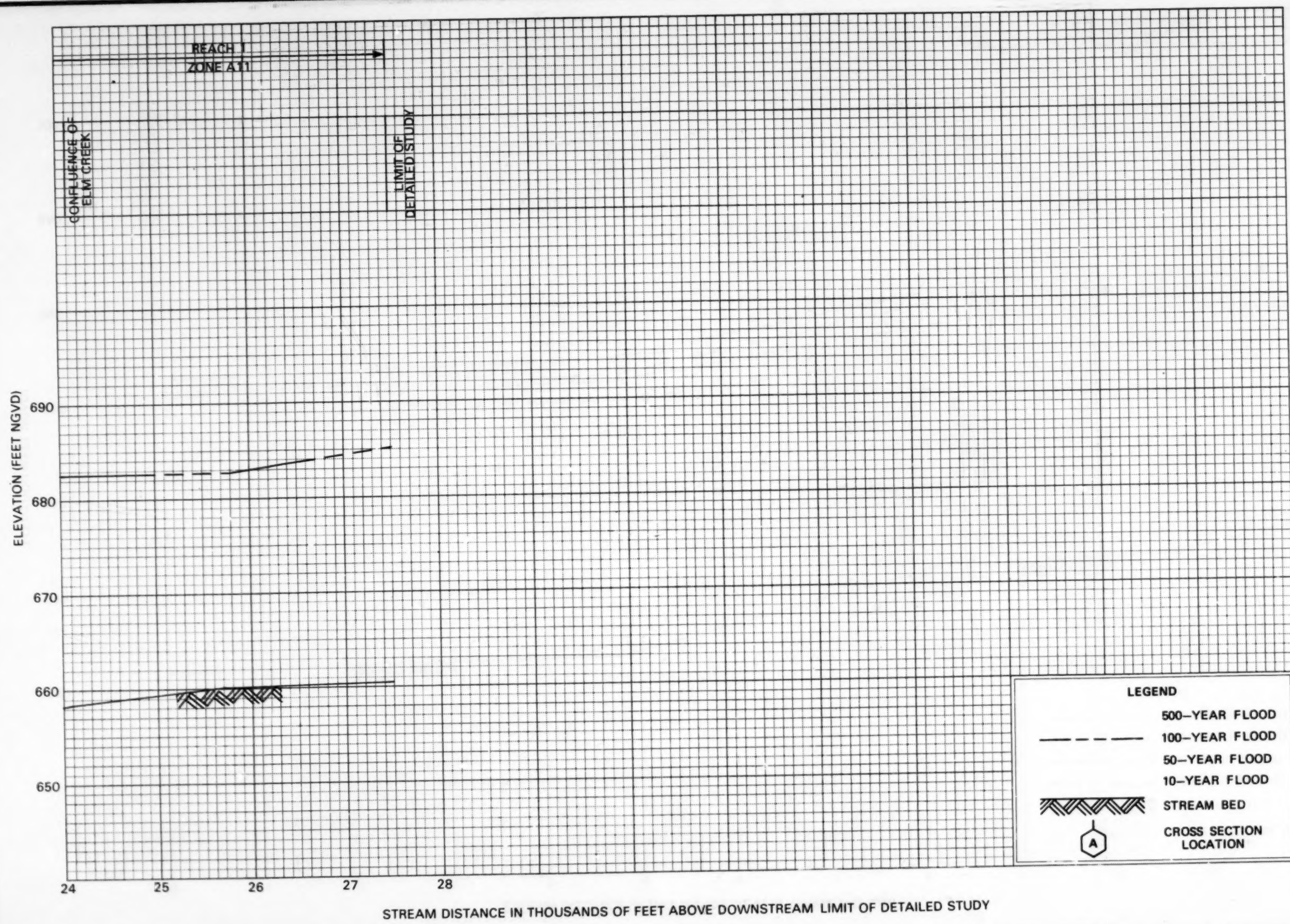
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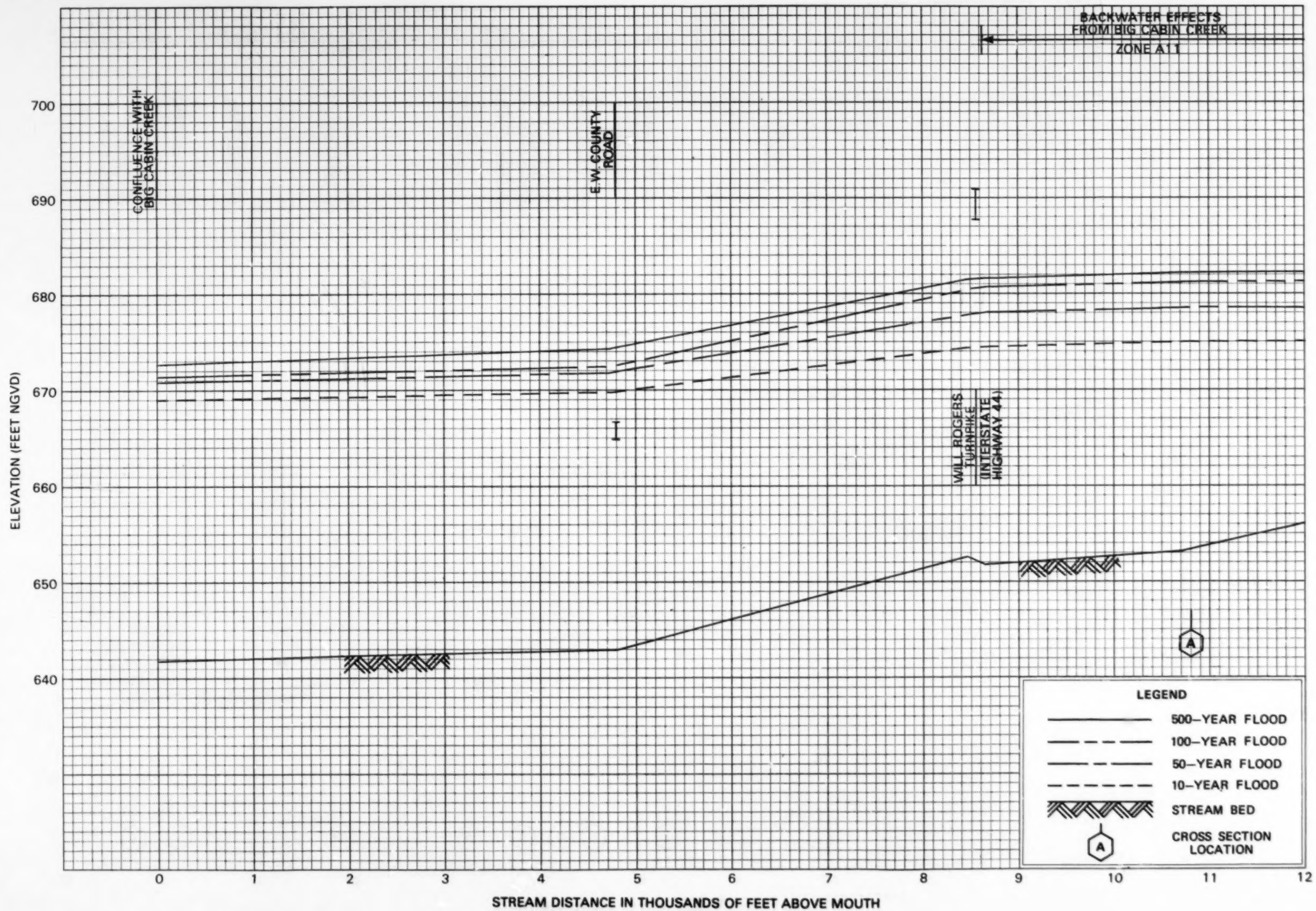
FLOOD PROFILES

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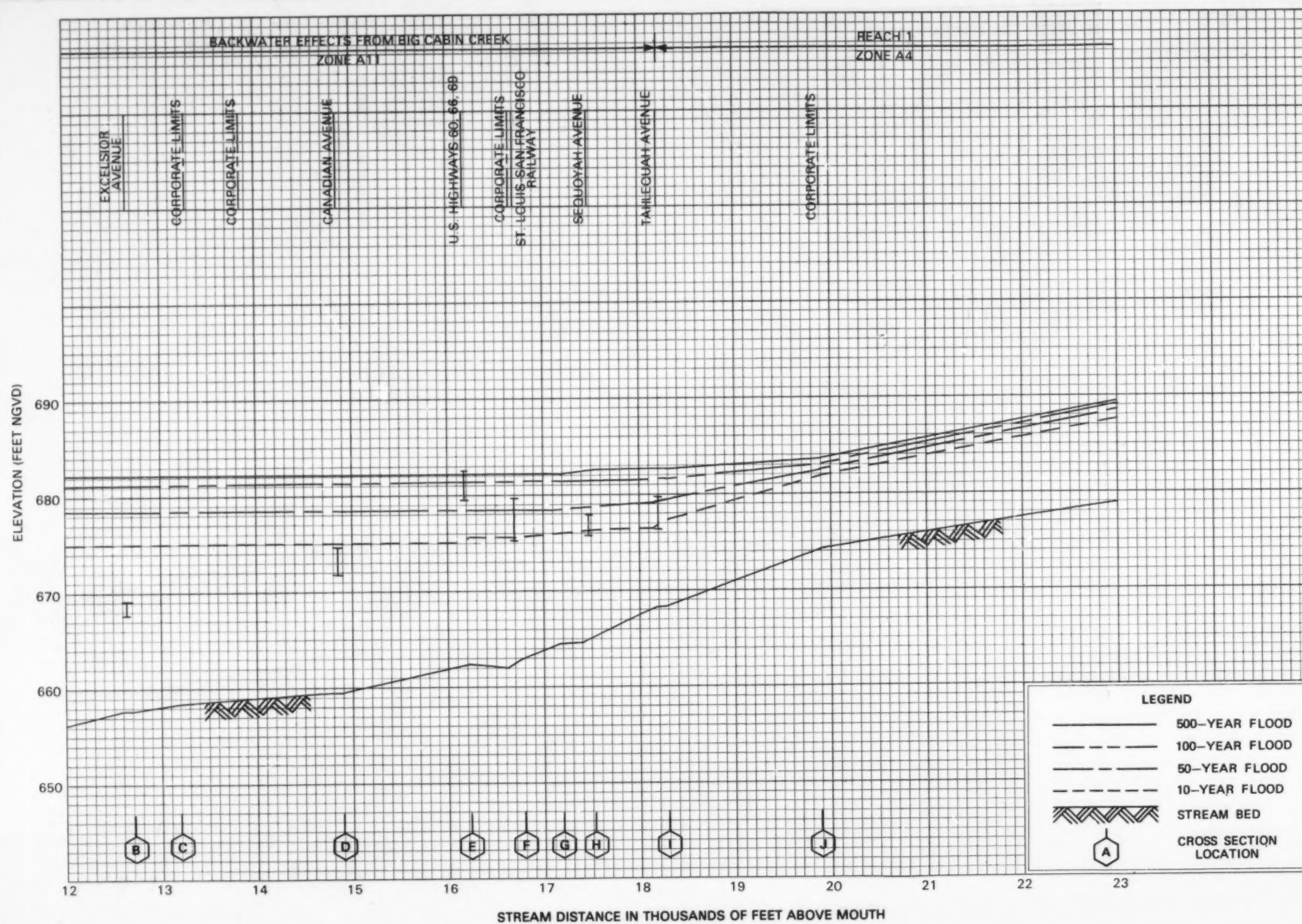
FLOOD PROFILES

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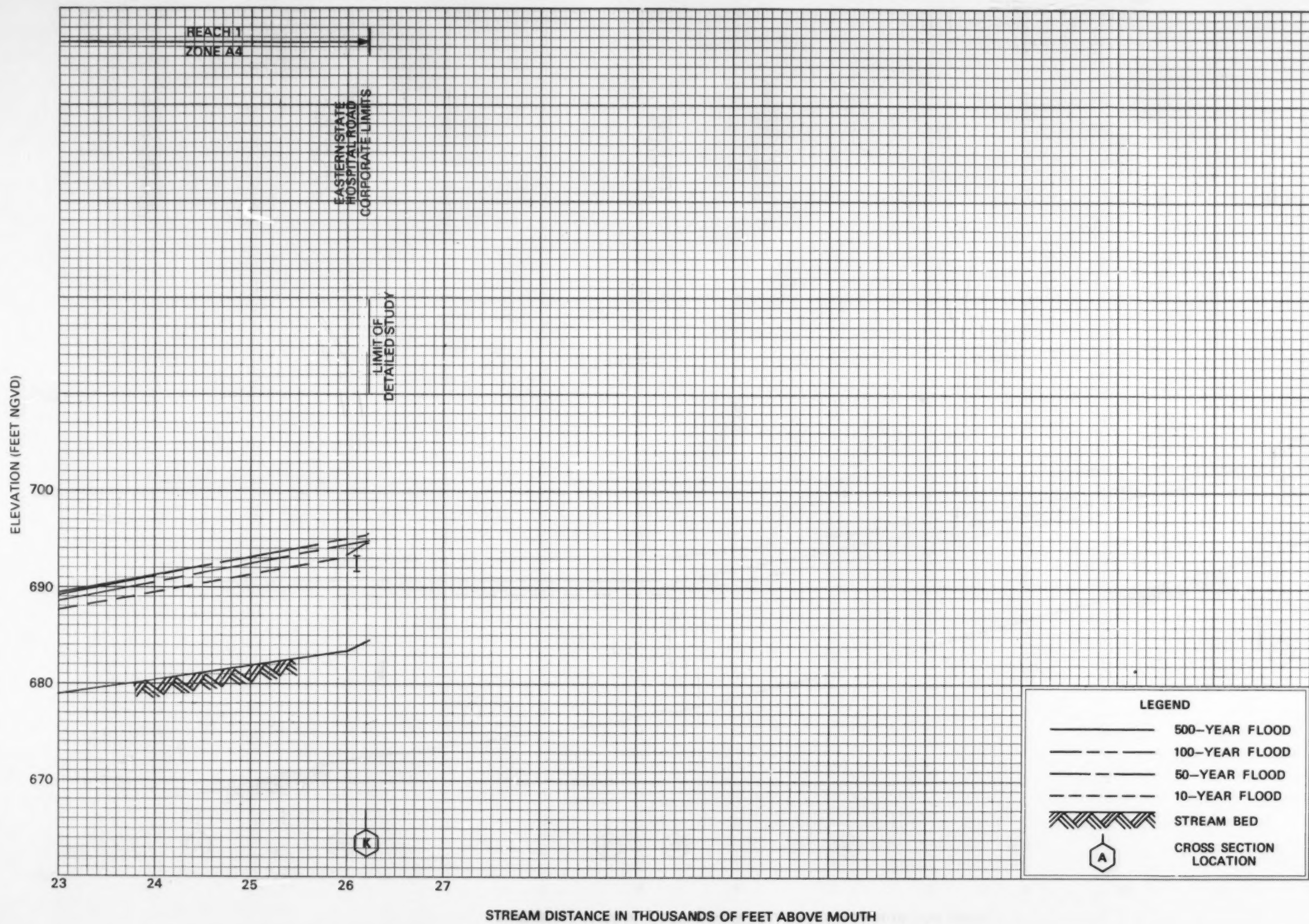
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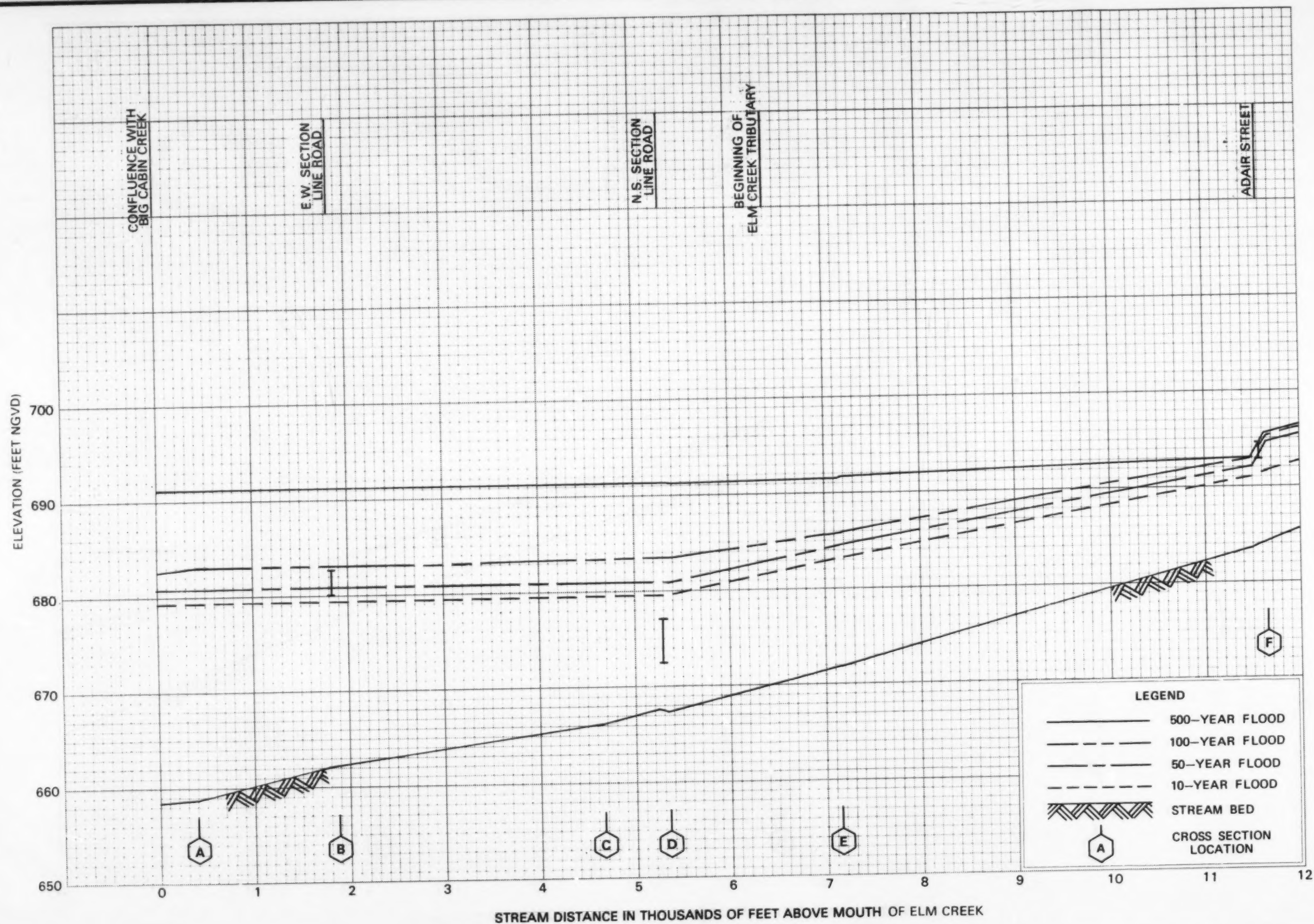
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FLOOD PROFILES

ELM CREEK - ELM CREEK TRIBUTARY

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